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AIR FORCE RESEARCH LABORATORY

Spatial Orientation Retention Device – Current Status

William B. Albery

AIR FORCE RESEARCH LABORATORY

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Interim Report for April 2005 to June 2005

Human Effectiveness Directorate
Biosciences and Protection Division
Aircrew Performance and Protection Branch
Wright-Patterson AFB OH 45433

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14. ABSTRACT
A multisensory aircraft attitude tool is described that will allow the pilot to canalize his/her attention and perform out-the-cockpit visual tasks without having to continuously bring his/her vision back into the cockpit to monitor aircraft attitude instruments. Aircraft attitude information currently displayed on head-down displays (HDD) and head-up displays (HUD) is supplemented by tactile cues, audio cues, and helmet-mounted symbology that reinforce attitude information about the state of the aircraft in real time. Tactile and audio cues give the pilot information about the airspeed, altitude, heading and bank and pitch of the aircraft without having to constantly monitor in-cockpit HUD and HDD displays. The Spatial Orientation Retention Device (SORD) will help reduce pilot workload by reassuring the pilot about his/her aircraft attitude and eliminate the requirement of having to focus on the cockpit displays. SORD is currently undergoing evaluation in the Air Force Research Laboratory in both a fixed-base and dynamic flight simulators.

15. SUBJECT TERMS
tactile; display symbology; visual performance; 3-D audio; orientation math models

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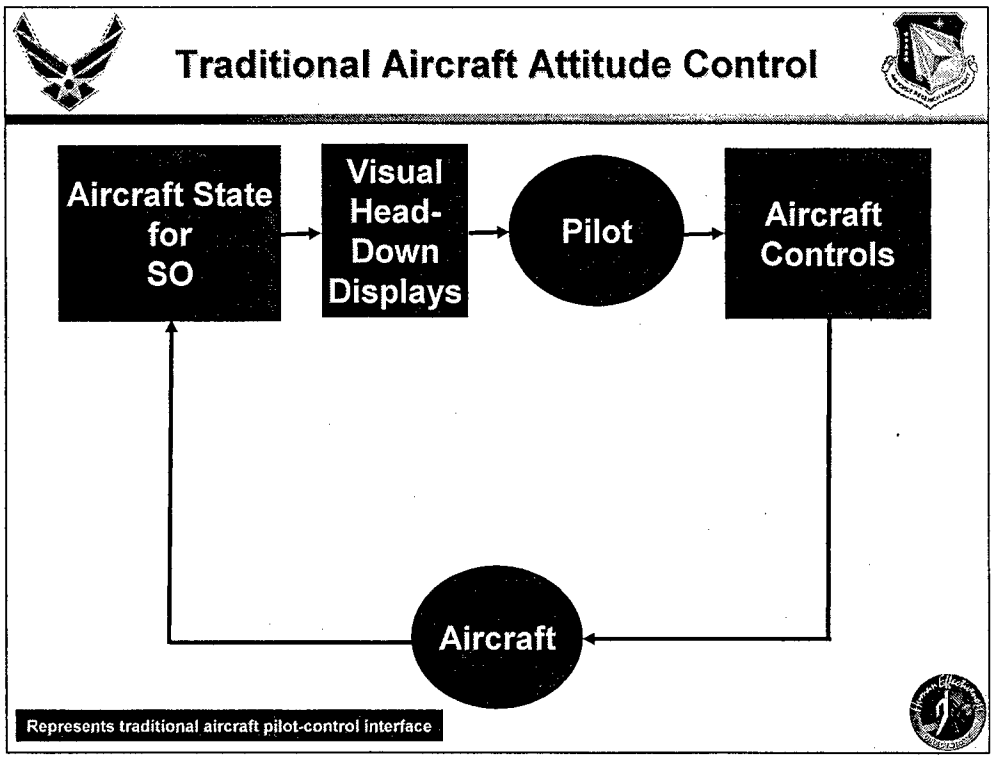
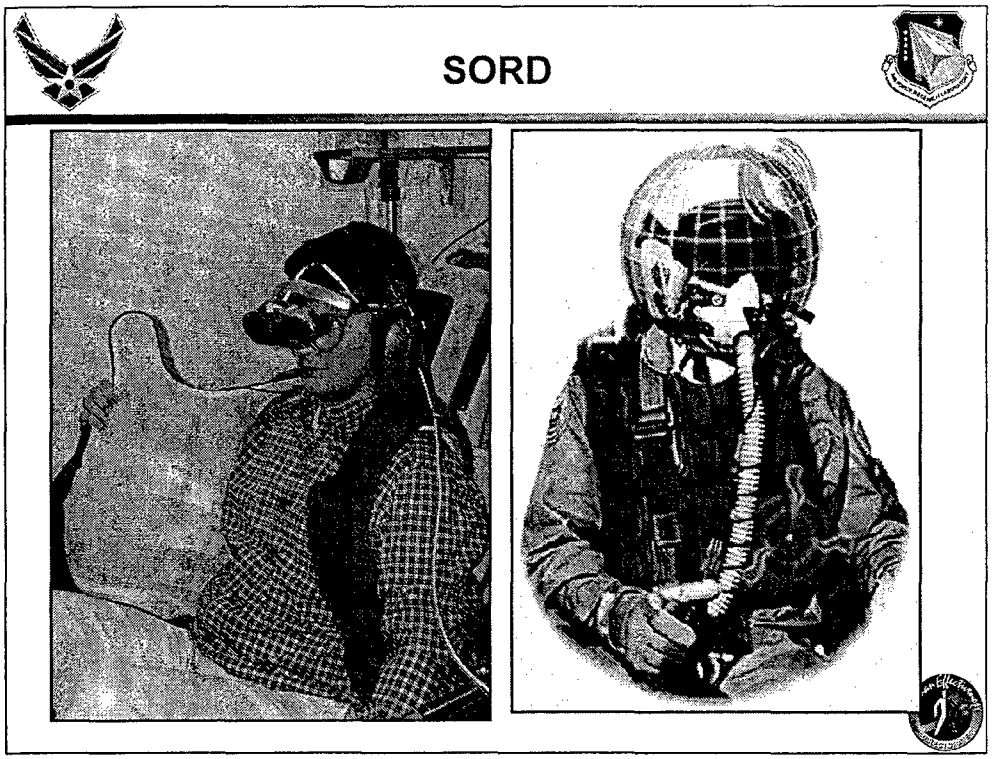
SAFE Association Oct 2005

Dr. Bill Albery
SD Prog Tech Mgr
Human Effectiveness Directorate
Air Force Research Laboratory

My name is Bill Albery. I was the Technical manager for the USAF's Spatial Disorientation Countermeasure program from 2001-2005. Welcome to our session today. I will start off with a presentation on some technology that we developed.

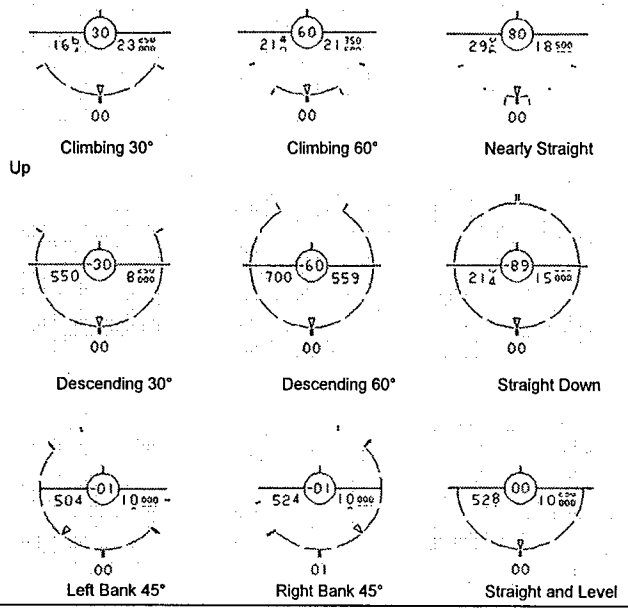


This diagram shows the traditional aircraft attitude control loop



A prototype of SORD is shown on the left including a tactile vest, helmet-mounted display, and 3-D audio headphones. The artist's concept of SORD is shown on the right.

NDFR Bank/Pitch Symbology



The NDFR conveys dive angles by increasing the amount of attitude arc displayed to form a more complete circle. During climb, the attitude arc shrinks to indicate increasing climb angles until, at 90 degrees climb, only the NDFR gap marks remain. Bank angles are determined by comparing the center of the attitude arc to the aircraft symbol.

How Does SORD Work?

- SD – SORD will provide attitude information via tactile and audio cues when pitch, over bank thresholds are surpassed; off-boresight symbology will provide continuous aircraft orientation info
- CFIT – SORD would provide over bank and pitch tactile cues or a tactile and/or audio cue when altitude thresholds are broached
- LSA – SORD can provide specific tactile cues on the torso (to pinpoint the location of friendlies/foes in the battlespace environment)

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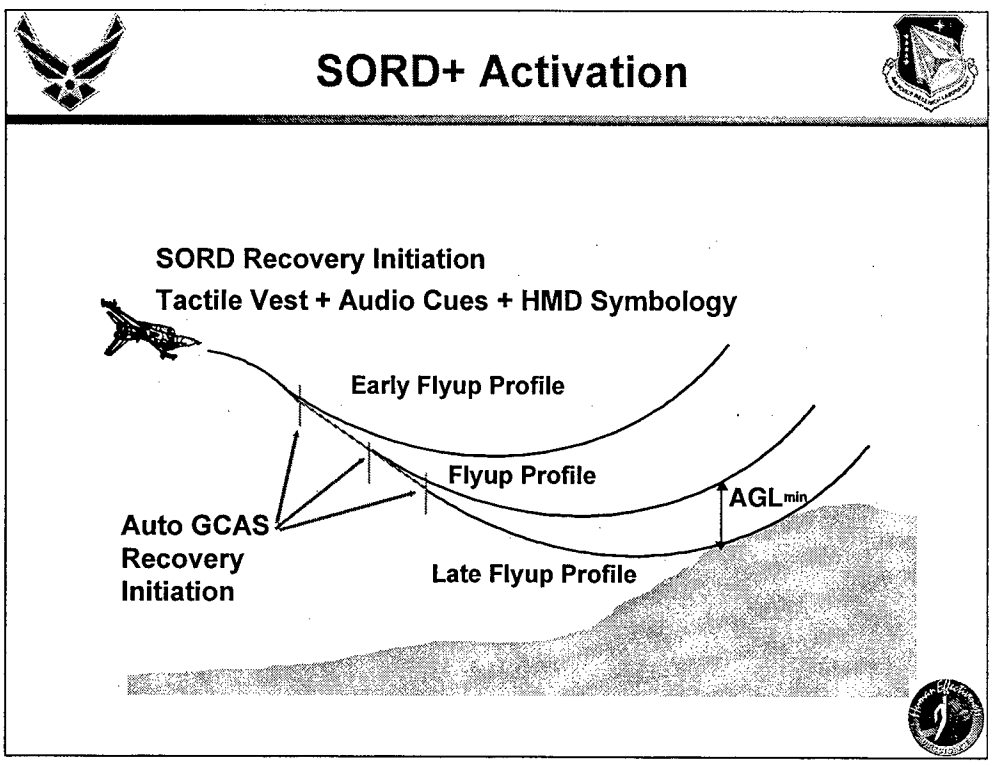


The automatic activation sequence begins at a particular altitude or distance from an object. SORD recovery initiation begins some time before the automatic sequence begins. SORD provides tactile and audio cues before AGCAS or AACAS is activated.

Current Tactile Research at WSU

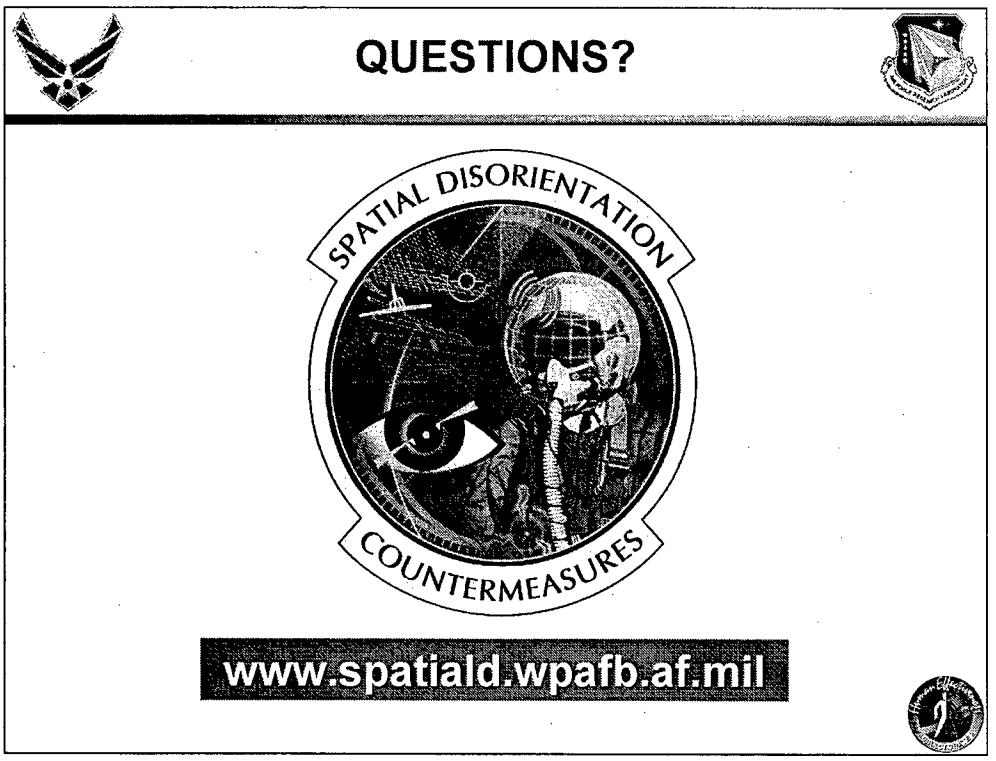
Goal:

Improve methods of displaying information about target aircraft to a pilot through tactile displays on the torso – tactile and NDFR

Specific Aims:

- Determine optimal azimuth resolution of the tactile display
- Establish optimal method of presenting target aircraft altitude information
- Assess whether coding symbology to identify types of aircraft is useful and effective

Andy McKinley will provide the details of this study in an upcoming presentation



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